SITA

THE SKY IS NOT THE LIMIT

AIRCOM Data Link

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SITA
THE SKY IS NOT THE LIMIT

Overview

- Datalink Migration Path
- SITA Infrastructure Upgrade
- New generation VHF Ground Station VGS
- VDL Avionics Qualification
- SITA VDL/ATN Milestones
- What's Next

From ACARS to VDL/ATN

- The ICAO plan for ATN implementation focuses on the provision of ATC datalink services.
- European and US ATC agencies plan to implement ATN/CPDLC systems (Miami B1, Maastricht P2L 2002, 2005 for B1A/Link2000+).
- ATN implementation in aircraft will be facilitated by the prior installation of CMU/VDR architecture.
- An interim VDL implementation in avionics justifies the deployment of a network of VDL ground stations which are ready to support ATN service.
- An Interim VDL implementation will provide experience of VDL use of the VHF band which is needed to plan for a system to support ATC datalink.

From ACARS to VDL/ATN

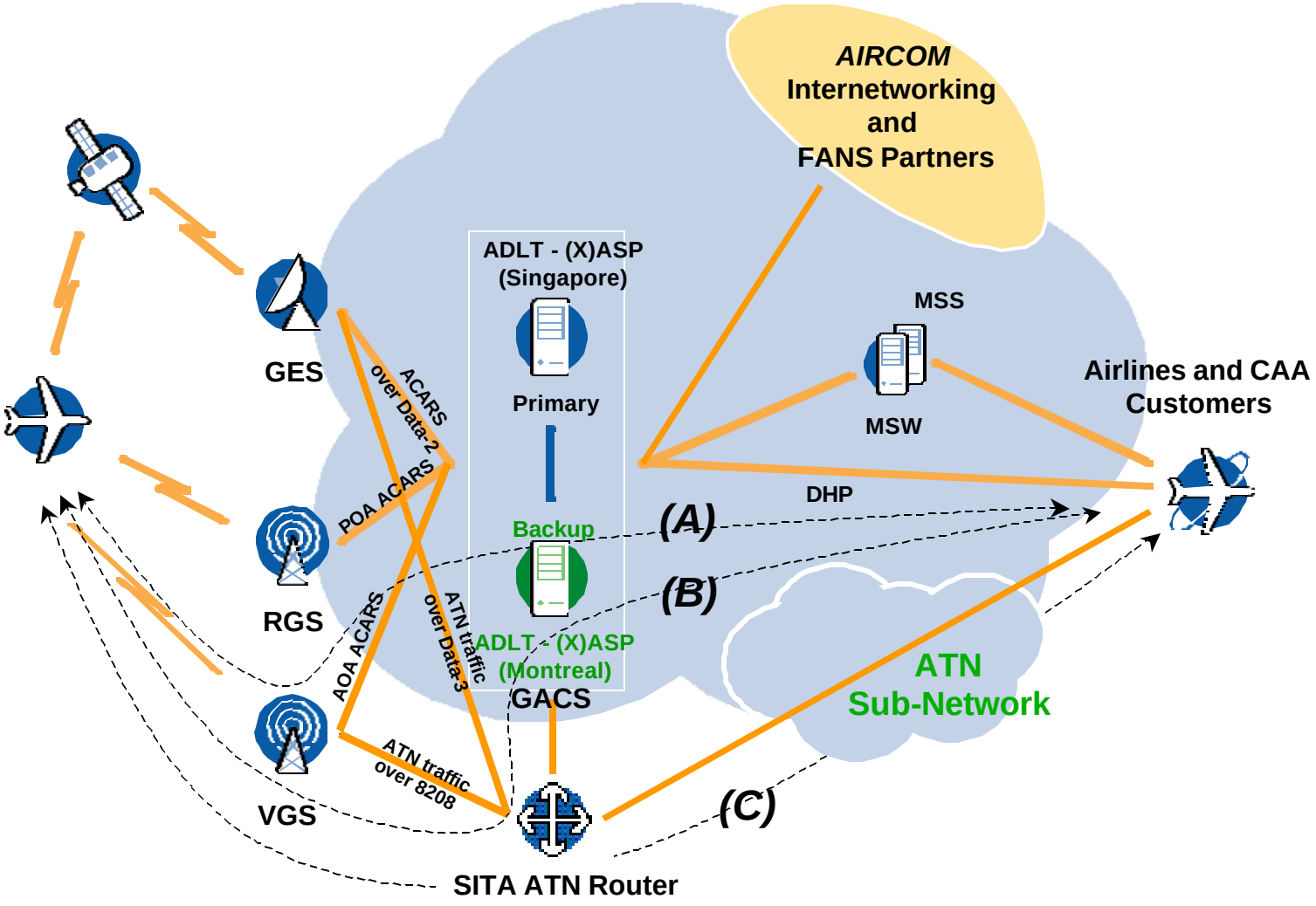
- **VHF ACARS network saturation in the high density airspace of Europe and the USA could be resolved by the use of VDL which provides 10-20 times more capacity per channel.**

- **Interim Solution = AOA (ACARS Over AVLC)**
  - **ACARS over AVLC (AOA) was presented to the AEEC Datalink Users Forum by AIRBUS/Boeing/SITA/ARINC.**
  - **ACARS over AVLC was recognized by the Users Forum as the optimum solution for airlines which decide to implement an interim VDL solution.**

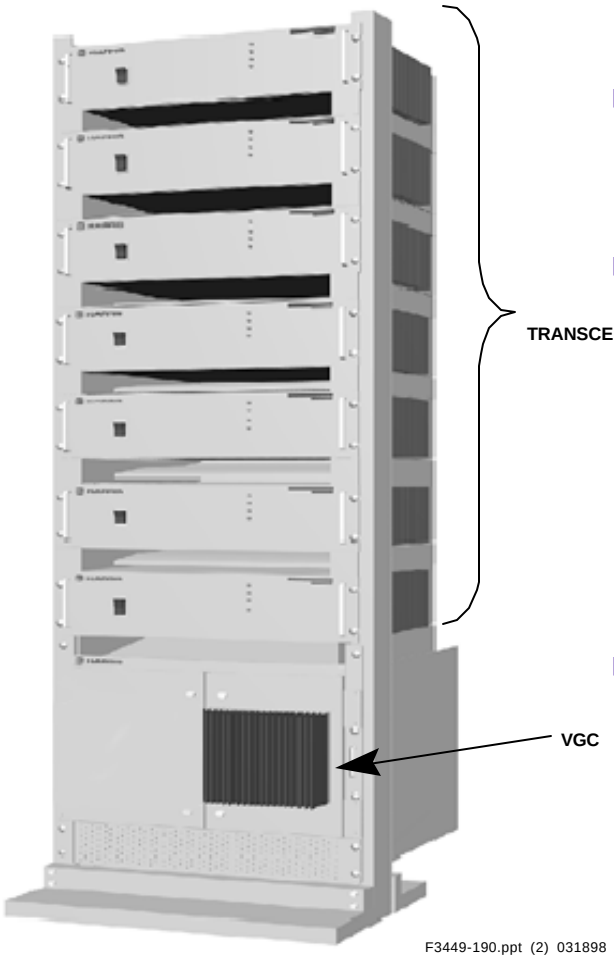
VDL AIRCOM Migration Path

- **Support of alternative implementation strategies**
  - ***(A)* Support of VDL avionics, ACARS applications and existing ground interfaces**
    - **Immediate performance improvements**
    - **Support AOA and ACARS when and where available**
  - ***(B)* GACS Implementation - Support ATN capable aircraft, using ACARS applications and existing ground interfaces**
    - **Early introduction of ATN avionics without the need to change applications or ground interfaces**
  - ***(C)* Support of full VDL and ATN avionics, applications and ground systems**

VDL AIRCOM Migration Path



SITA Infrastructure Upgrade



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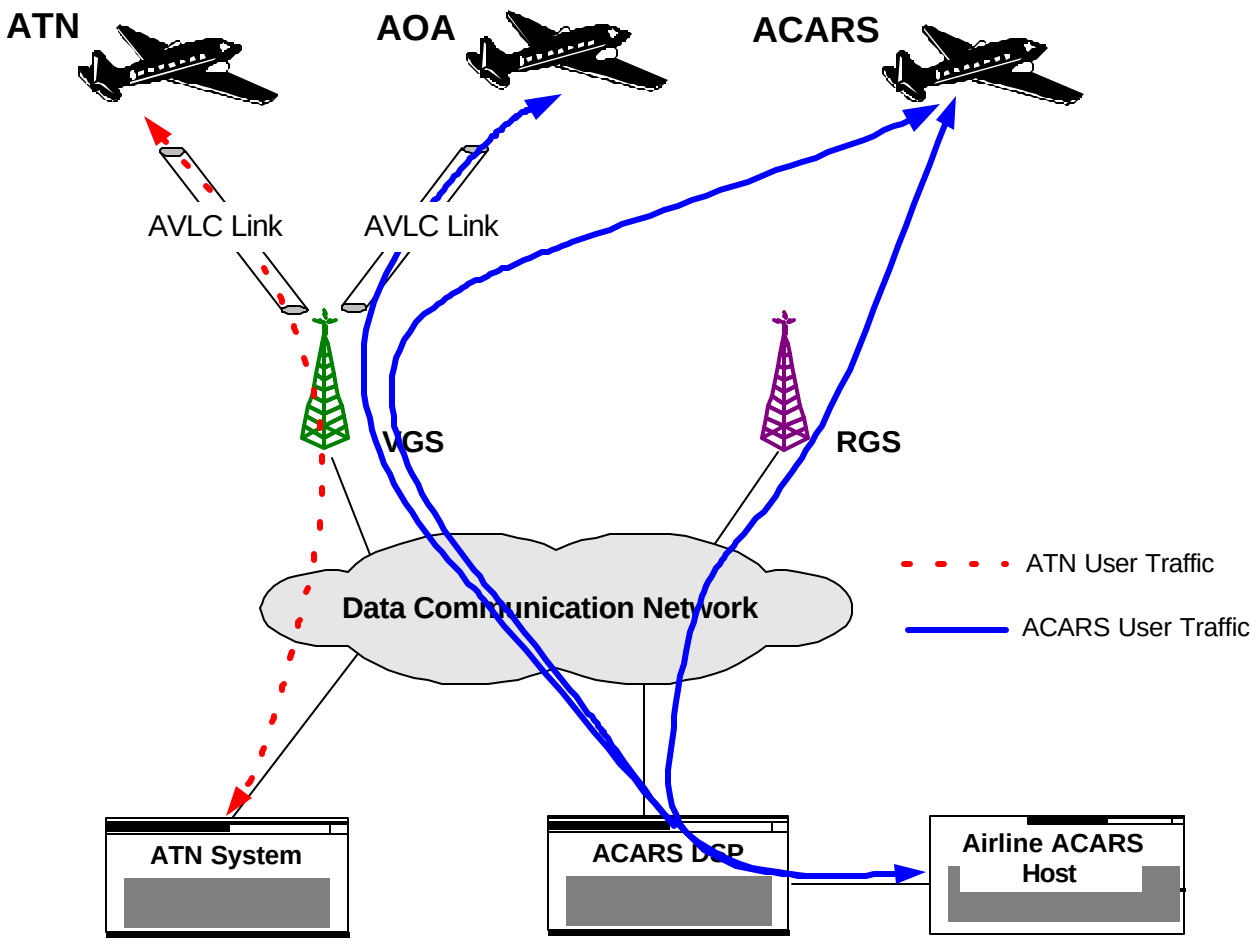
- Harris contracted to produce VGS according to SITA specifications
- VGS can simultaneously support
  - ACARS
  - VDL ACARS over AVLC (AOA)
  - VDL Mode 2/ATN
  - VDL Broadcast
- VGS are gradually replacing existing legacy ACARS stations

VGS


ATN
AOA
ACARS
AVLC Link
AVLC Link
VGS
RGS
Data Communication Network
ATN User Traffic
ACARS User Traffic
ATN System
ACARS DCP
Airline ACARS Host

VGS Basic Configuration

- **SITA's VGS basic Hardware components**
  - **Support a minimum of 7 transceivers**
    - **configured for ACARS or VDLM2**
  - **VHF Ground Computer (VGC)**
  - **WAN IP and legacy X.25 interface**
  - **No fans to preserve high availability**
    - **However, engineered to support high temperature range (worldwide deployment)**
  - **Basic Availability: 99.99%**

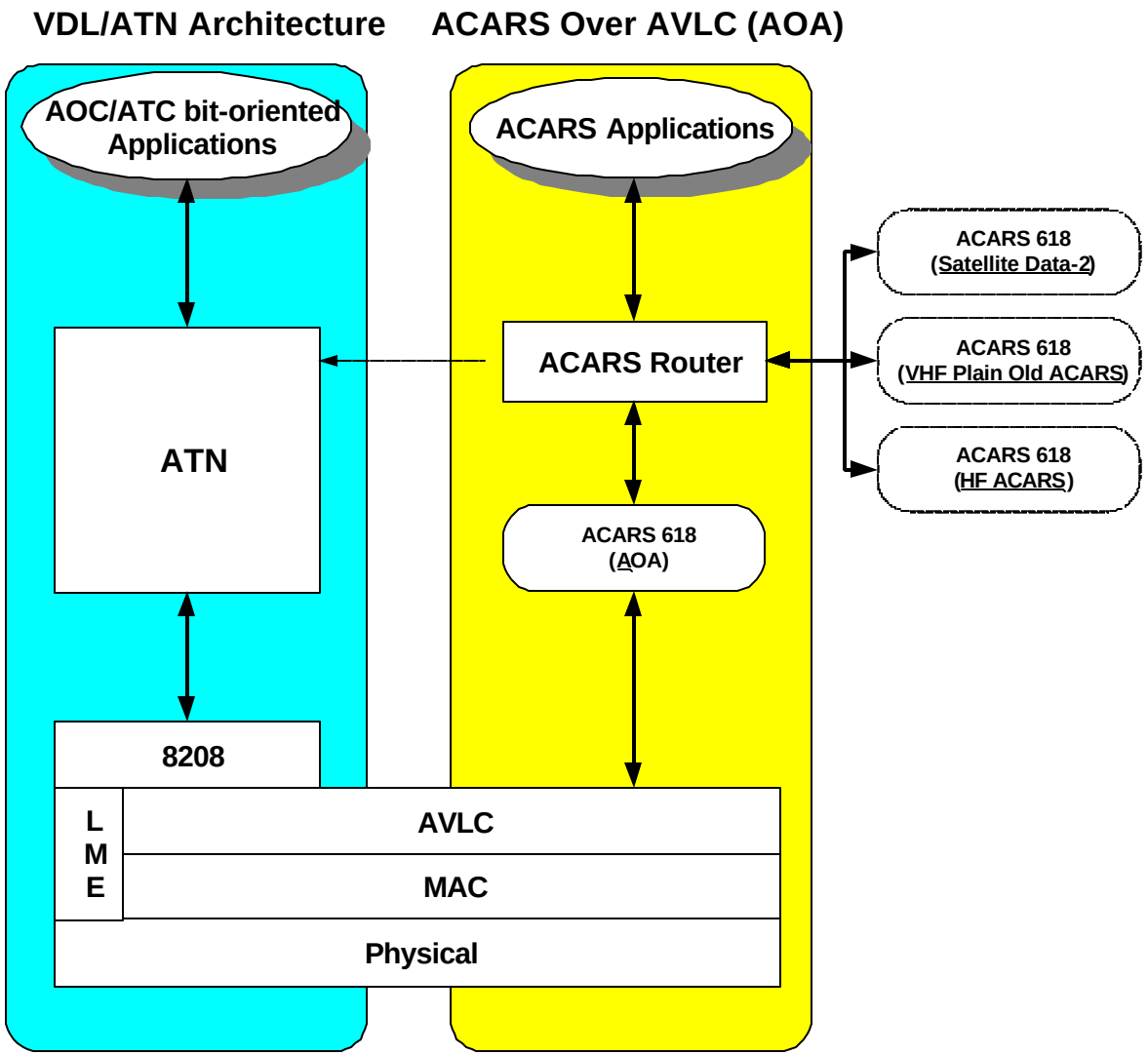
VGS Redundancy

- **SITA's VGS designed to meet CAA and Airline Service Availability requirements:**
  - **Standby transceivers**
  - **Dual CPU/load-balancing**
  - **Dual UPS**
  - **Dual Power Supply**
  - **Back-up X.25 interface (64kbps+)**
  - **Dual IP Router IP VPN/Frame Relay**
  - **ISDN Dial-backup**

VGS Network Management

- **SITA's VGS SNMP based NM**
  - **Supports Fault, Configuration, Accounting, Performance and Security**
    - **Remote download for both Radio and VGC**
  - **Real time reporting of faults, alarms to the Central Manager**
  - **Real time/deferred trace capability to support trouble shooting + Flight Test**

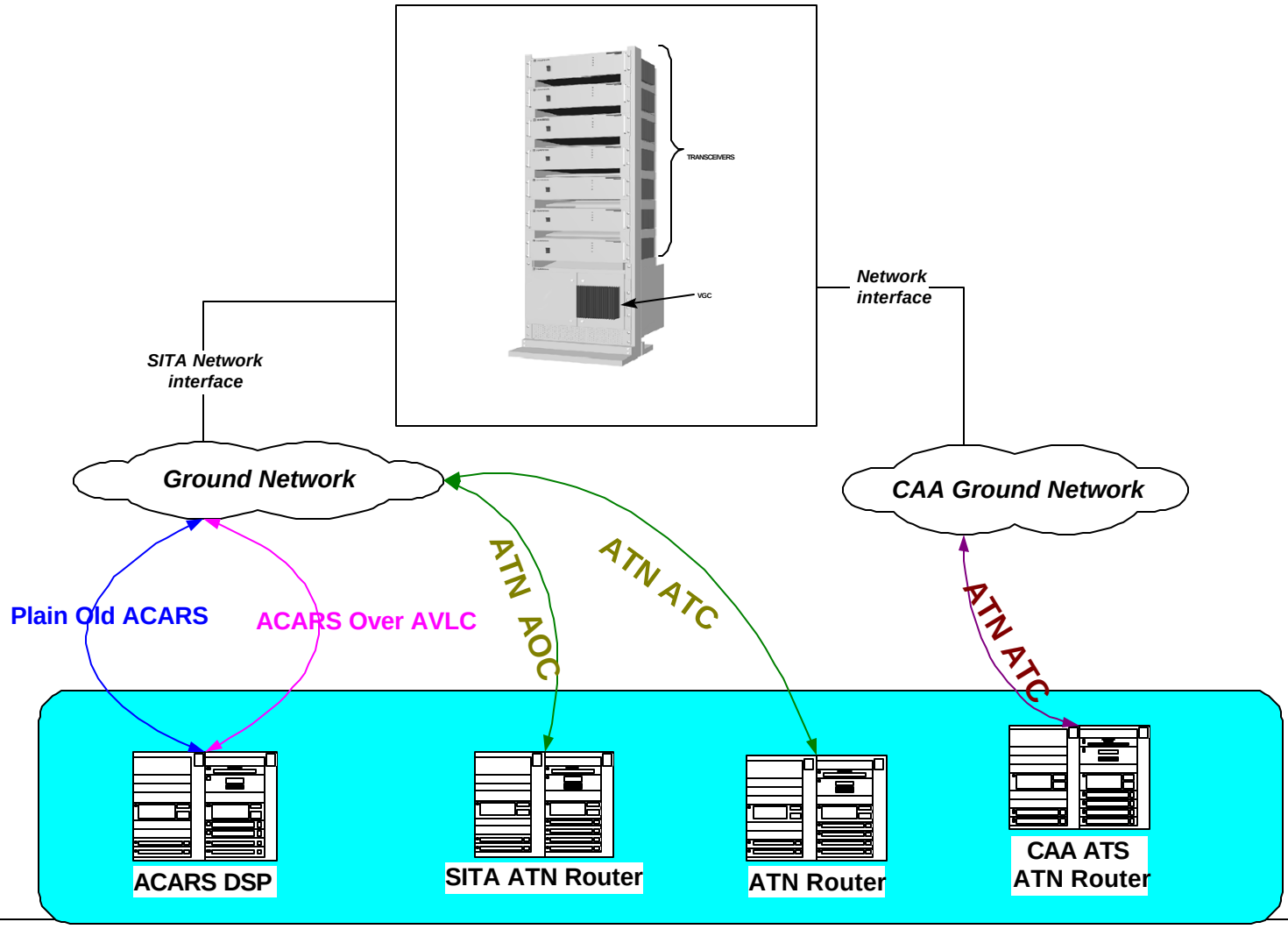
VDL /ATN Protocol Stacks



- **SITA supports ATN, AOA, VDL Broadcast to make full use of VDL capabilities in order to provide flexibility and performance improvements.**

ACARS, AOA, VDL/ATN

VGS supports ACARS, AOA and VDL/ATN



VDL Avionics Qualification

Requirements and Setup for VDL

- **Present SITA VAQ covers VHF, SATCOM and HFDL (via simulation) avionics**
- **VDL equipped aircraft will require additional testing related to:**
  - **POA to AOA/ATN switchover**
  - **VDL protocol implementation**
  - **RF performance**
  - **Multimedia handling**
  - **System management**
  - **ATN connectivity**
- **VAQ test-bed requires upgrade to enable these tests**

Scope of VDL Testing

- SITA VAQ facility will cover every aspect of functionality and operation of the Mode 2 protocol between the avionics CMU and the ground system

- Service provider specific requirements

VDL Test Requirements

- **Standards**
  - **631/VDL SARPS, 618, 750, 758 compliance**
  - **637/GACS, ATN SARPS**
  - **Interoperability with SITA Ground Systems**
  - **VAQ Test Plan (same process as for ACARS)**
  - **Coordination with ARINC**
- **RF Interoperability/VDR-VGS**
  - **D8PSK mask**
  - **HFEC/MFEC /Bit Scrambling/Interleaving/FCS (do messages get through ?)**
  - **Co-channel/Adjacent channel (success rate)**
  - **VDR Buffering for RF burst and VDR delays**
- **CMU**
  - **A/G LME - G/G LME (XID sequence/parameter)**
  - **AVLC States (FRMR, SREJ, DM, ABM)**
  - **Handoffs - dual link, T5 - ACARS/VDL switch**
  - **AOA 618, 8208 protocol (Q0 on new link)-Round trip**

SITA VDL/ATN Milestones

- Interoperability testing between VDL avionics and VGS successfully performed at the VAQ testbed
  - Collins CMU, ATSU, Honeywell, Teledyne, Thales
- VGS installed at Rockwell Collins, Teledyne, Honeywell, Airbus for lab and over-the-air testing
- Extensive Testing with Eurocontrol at Boscombe Down for ATN CPDLC (same version as used in B1)
  - Successful Flight Tests with the BAC1-11
- SITA is involved in GACS testing with Eurocontrol
  - Successful end-to-end testing
- Upcoming testing with Airbus for ATN over VDL and SATCOM Data-3

What's Next ?

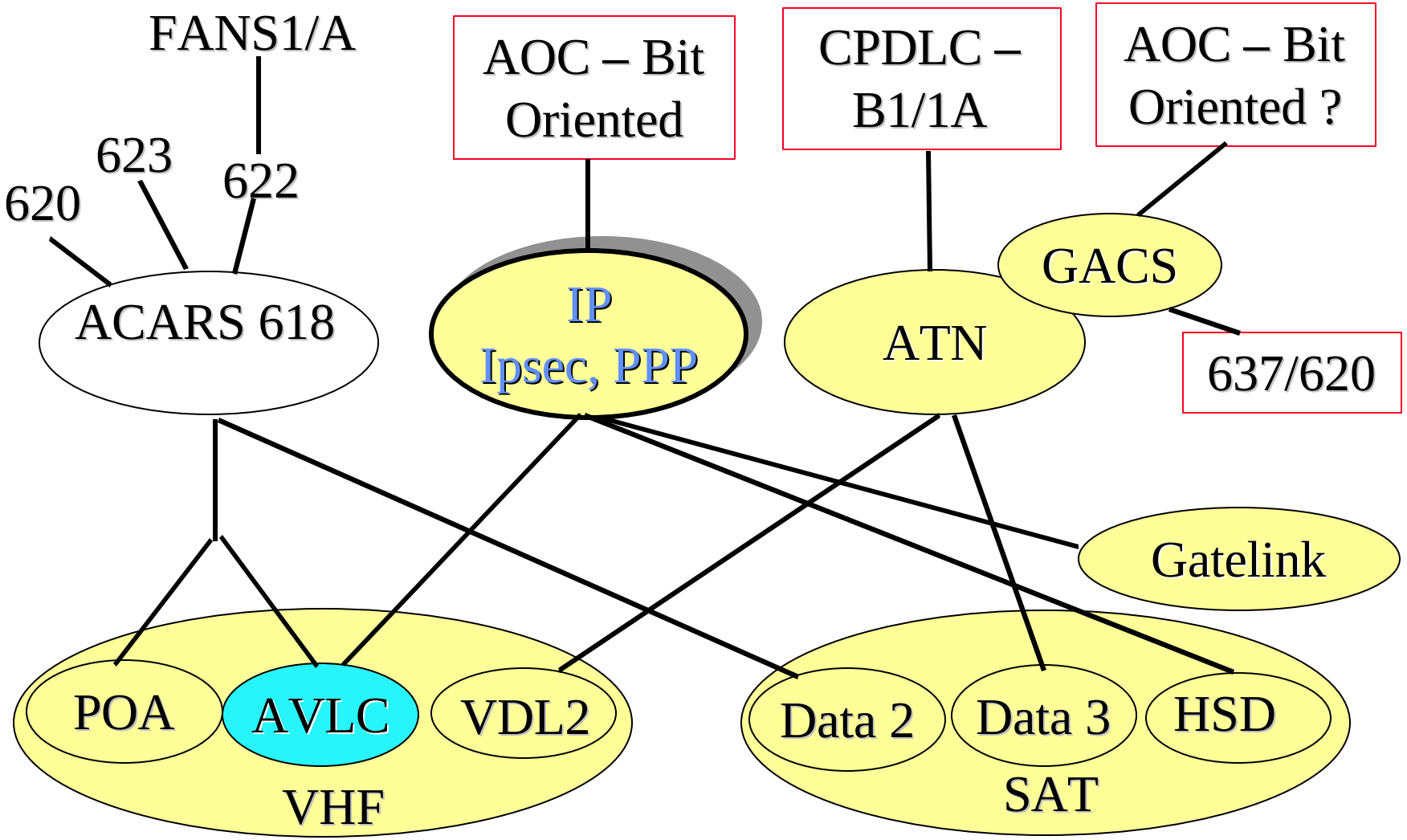
Next step after AOA/ATN CPDLC

- SITA has completed development of VDL Mode 2 AVLC (AOA) support for ACARS and ATN/CPDLC.
- What is the next step for VDL Mode 2 data link ?
  - ATN GACS interface for AOC.
    - Enables ACARS applications to use an ATN router as per AEEC 637 specification
    - potential enabler for Bit-Oriented Applications, SITA supports Trials with Eurocontrol.
  - IP Solution for AOC ?
    - VDL/Satcom links that today support ACARS could also support an IP router for AOC in parallel with an ATN router for ATS ?

AOC Bit Oriented Applications

- IP offers a vast variety of applications: FTP, SNMP…
  - ATN may have limited offering (ATN FTAM Server not readily available for File transfer)
  - Cost effective solution using IP (compare CMIP with SNMP)
- Communications Security is addressed with IP
  - VPN IPsec implements Authentication, Encryption, Tunneling (subset of IPV6)
  - IPV4
  - IPV6
  - PPP

? ……..IP for AOC


FANS1/A
AOC – Bit Oriented
CPDLC – B1/1A
AOC – Bit Oriented ?
620
623
622
ACARS 618
IP
Ipsec, PPP
ATN
GACS
637/620
Gatelink
POA
AVLC
VDL2
VHF
Data 2
Data 3
HSD
SAT

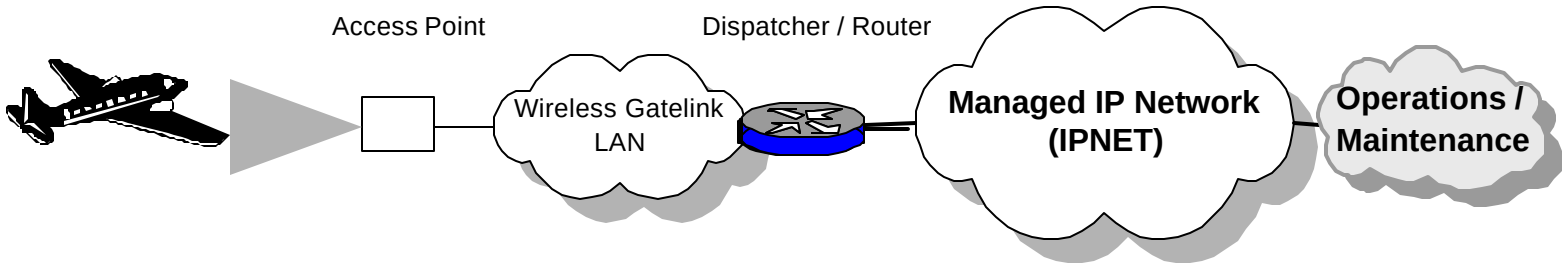
IP/ Satcom Swift64

- **Satellite AIRCOM Swift64**
  - **Services provide communication services for airlines' aircraft to access Ground systems via two-way high-rate TCP/IP link.**

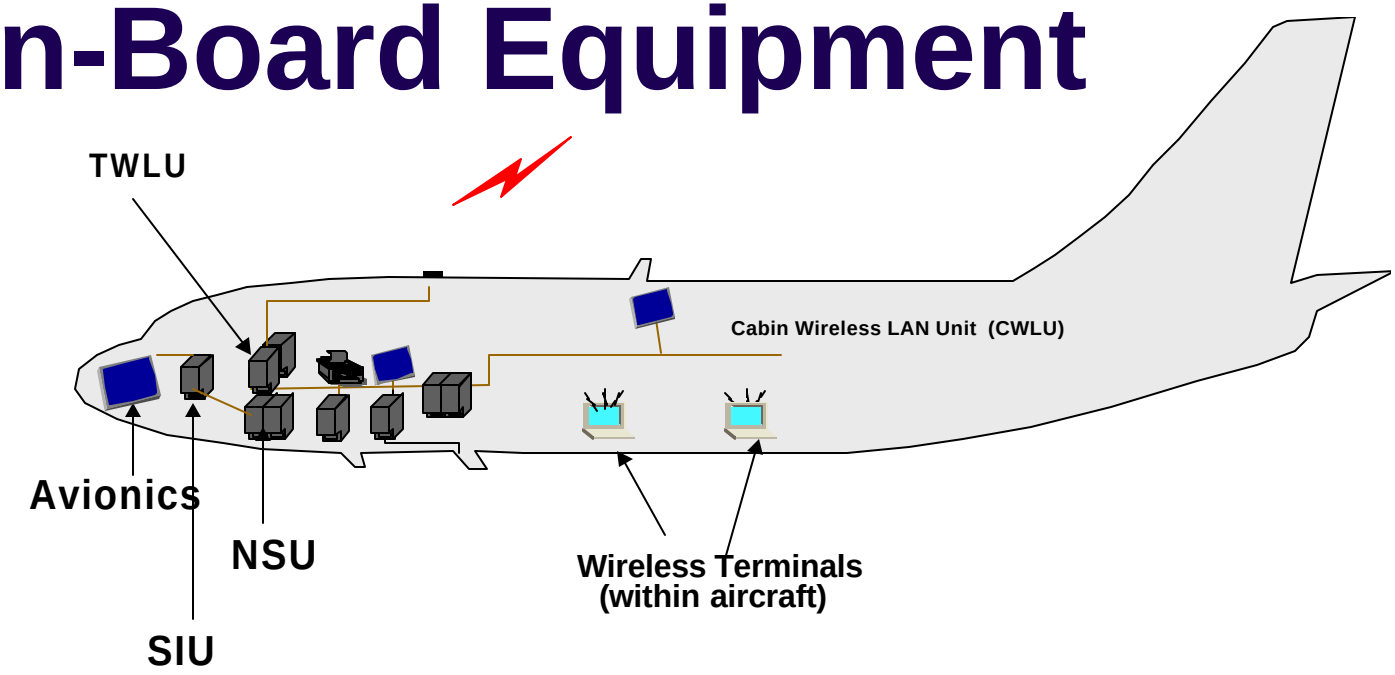
- **Two new Satellite services developed by INMARSAT**
  - **the circuit-mode service (Inmarsat Swift64 Mobile ISDN Service referred to as MISDN) and the packet-mode service (Inmarsat Swift64 Mobile Packet Data Service referred to as MPDS).**

IP / Gatelink

- **IEEE 802.11 defines a standard for Wireless LAN communications:**
  - **Specifies layer 1 (FHSS/DSSS/Infra-red)**
  - **Throughput up to 2 Mpbs**
  - **Specifies layer 2**
  - **Link layer is seen as a standard MAC layer by higher level protocols (e.g. IP)**



On-Board Equipment



- On-board Router - NSS composed of:
  - Network Server Unit (NSU)
    - both a file server and IP router
    - System offering Ethernet Interfaces
  - Server Interface Unit (SIU)
    - addresses legacy avionics end-systems

Integrated IP Solution

- **PPPoE (PPP Over Ethernet) – RFC 2516**
  - **Common interface to all on-board IP Host**
    - **Two stage: Discovery stage and a PPP Session stage.**
    - **In the Discovery process, a Host discovers Access Concentrators**
  - **Interfacing to the NSS (On-board IP Router/File Server):**
    - **For Satcom, the MES should be the access concentrator**
    - **For Gatelink, the access concentrator should be at the airport and may provide access to several service providers**
    - **For VDL2, the CMU should offer an Ethernet interface to be the access concentrator**

Integrated IP Solution